REMARKS

Upon entry of the present Amendment, claims 25-41, 44-48 and 65-78 will be pending. Support for amended claims 25 and 44 for reciting "at least two electrode elements non-movably adapted along a portion of said chamber" and "at least one piezoelectric transducer non-movably adapted along a portion of said chamber" can be found throughout the application and, *inter alia*, in Figures 1-10 of the present specification. Claims 65, 68, 72 and 75 are amended to correct a typographic error. The above-described amendments do not introduce any new matter into the present application.

Rejection under 35 U.S.C. § 103

Claims 25-41, 44-48, 65-78 are rejected under 35 U.S.C. 103(a) as allegedly being unpatentable over Yasuda, et al., U.S. Patent No. 6,216,538 (Yasuda) in view of Becker, et al., U.S. Patent No. 6,294,063 (Becker). The Examiner recognized that Yasuda does not specifically teach inlet and outlet ports or an array of electrodes.

Yasuda is alleged to teach the following:

- an electrophoretic and acoustic force apparatus for field flow fractionation with carrier medium (col. 3, l. 19-35; col. 7, l. 15-20; col. 9, l. 58-63; col. 12, l. 63).
- At least two electrode and at least two piezoelectric transducers are taught (acoustic - col. 5, l. 62 - col. 6, l. 2; col. 6, l. 43-49; col. 7, l. 26-29, 44-48; col. 11, l. 11-17; col. 15, l. 45-49; electric - col. 10, l. 33-34, 38-45; col. 11, l. 18-24; col. 12, l. 13; col. 15, l. 43-44).
- Phase of the wave can be varied as well as the amplitude which can create an inhomogeneous acoustic field (col. 6, l. 30-42).

- The acoustic wave generating elements can be switched back and forth to be either wave sending or wave receiving and each element can be individually controlled (col. 7, l. 57 - col. 8, 1. 5; col. 8, 1. 33-36).
- Example 1 teaches a method of sequential and or simultaneous use of both electrophoretic and acoustic fields.

Becker is alleged to teach the following:

- Multiple inlet and outlet ports in an electrophoretic field flow fractionation apparatus as well as an array of electrodes (col. 4, 1. 46 - col. 5, 1. 3) for manipulation of sample (Figures 9, 9B, 11, 12, 13).
- A chamber with at least one inlet port and at least one outlet port (col. 3, l. 26-28) with at least two electrode elements and preferably an electrode array disposed along a portion of the chamber energized by an electrical signal generator to create an electrical field to cause an electrophoretic force normal to the traveling direction of a carrier medium (col. 3, l. 49 - col. 4, 1. 10, 35-40) whereby the chamber may be a tube (col. 28, 1. 1-2).
- The AC or DC signal generator can be connected to a plurality of electrical conductor buses connected to more than two individual electrode elements (col. 7, 1. 16-36; col. 20, l. 34-56).
- Alternately, electrode elements can be adapted longitudinally or latitudinally along the inside or outside of the chamber whereby the array may be parallel, interdigitated, castellated, polynomial or plane (col. 4, 1. 1-40, 47-50).
- Electrode elements are made of metal layer(s) on the surface of the chamber, particularly gold and chromium (col. 7, 1. 16-21; col. 20, 1. 56-62). These

elements create a spatially inhomogeneous electric field (col. 5, 1. 9-20) to vary the magnitude and frequency of the electrical signals (col. 4, 1. 64 - col. 5, 1. 8).

- Becker teaches introducing a medium into the apparatus (Example I, col. 16, 1. 16 - col. 17, 1. 51) and into the chamber giving a velocity profile and applying at least one electrical signal to provide an electrophoretic force on the medium normal to the traveling direction of the carrier medium and a second electrical signal used to generate an acoustic wave to displace matter normal to the direction of the carrier medium.

The Examiner alleged that it would have been obvious to one of ordinary skill in the art to provide inlet and outlet ports so that the flow can go into one part of the device and out another part of the device as well as provide an array of electrodes so that electrical and acoustic fields may be generated and/or controlled simultaneously because Yasuda teaches both electrical fields for electrophoretic purposes as well as acoustic fields to focus separations in a capillary or flat surface and it would be easier to control both acoustic and electrical fields both individually and simultaneously so that sample position, separation and spatial relation and detection can be done easily and automated by computer.

This rejection is respectfully traversed. Yasuda and Becker, whether alone or in combination, do not render the presently claimed invention obvious because there is no motivation, whether explicitly or implicitly, to combine the teachings of Yasuda and Becker to arrive at the presently claimed apparatuses and methods.

The presently claimed apparatuses and methods use both electrical force and acoustic force in field-flow-fractionation analysis. The present obviousness rejection is based on the Examiner's assertion that Yasuda teaches the use of both electrical force and acoustic force in

field-flow-fractionation analysis, but does not specifically teach the use of inlet and outlet ports or an array of electrodes. The Examiner's assertion on Yasuda's teaching is incorrect for a number of reasons.

First, the presently claimed apparatuses and methods are used for field-flow-fractionation analysis. One of the limitations of the presently claimed apparatuses and methods is "a chamber having at least one inlet port and at least one outlet port, said chamber having such structural characteristics that when a carried medium is caused to travel through said chamber, the traveling velocity of said carried medium at various positions within said chamber is different" (*See e.g.*, Section a) of claims 25 and 44). As recognized by the examiner, none of the apparatuses taught in Yasuda has an inlet port and an outlet port. Without any inlet and outlet ports, how can any carried medium be caused to travel through such apparatuses? And without a traveling fluid, there would be no traveling velocity of the carried medium, let alone different traveling velocities of the carried medium at various positions within a chamber. Indeed, the apparatuses, especially the apparatuses that alleged by the Examiner to use both electrical force and acoustic force, *i.e.*, apparatuses as shown in Figures 10-13 are fluidically closed systems, and for their intended purposes, they must be fluidically closed systems.

Second, none of the apparatuses taught in Yasuda uses both at least two electrode elements to cause at least one electrophoretic force having components normal to the traveling direction of the carrier medium on a matter in the carrier medium and at least one piezoelectric transducer to cause at least one acoustic force having components normal to the traveling direction of the carrier medium on a matter in the carrier medium. For example, in the apparatuses shown in Figure 10 of Yasuda, the electrodes 33 are used to cause cell fusion and are not used to maintain cell positions (*See* Yasuda at column 10, lines 19-45). Only acoustic force

is used to maintain or change cell positions. *Id.* Similarly, the apparatuses shown in Figure 11 of Yasuda does not use both electrophoretic force and acoustic force. At column 11, lines 18-24, Yasuda teaches:

> In this embodiment, ultrasonic waves are used as the means for trapping a particle as a target, and means for causing a chemical substance to act locally is used as the cell fusion means. However, the means for supplying the chemical substance for local action with this micro-pipetting unit may be used when a cell is trapped by pipette suction, an electric field trap, an optical trap, etc (emphasis added).

This teaching shows that the cell is trapped by either acoustic force or electrophoretic force, but not both. At column 12, lines 1-3, Yasuda teaches:

> Instead of using ultrasonic waves, other methods such as applying an electric field or adding a cell fusion accelerator may be used.

This teaching shows that, for the apparatuses shown in Figure 12 of Yasuda, electrophoretic force is only used for cell fusion, not for positioning the cell. For the apparatuses shown in Figure 13 of Yasuda, electrophoretic force is used to drive particle movement in the gel-electrophoresis (*See* Yasuda at column 15, line 36 through column 16, line 27). Accordingly, the electrophoretic force is in the direction of particle movement, not normal to the direction of the particle movement.

Becker does not cure the defects of Yasuda. The Examiner pointed to column 16, line 16 through column 17, line 51 of Becker to support the assertion that Becker teaches applying at least one electrical signal to provide an electrophoretic force on the medium normal to the traveling direction of the carrier medium and a second electrical signal used to generate an acoustic wave to displace matter normal to the direction of the carrier medium. A closer look at the portion cited by the Examiner indicates that Becker does not teach the use of acoustic wave

to displace matter normal to the direction of the carrier medium at all. At column 15, lines 45-50, Becker teaches:

> FIG. 6 shows a controller 81 according to one embodiment of the presently disclosed method and apparatus. Controller 81 may include a computer 80, a signal generator 82, an electrode selector 84, a transducer 88, and a fluidic device 10 having a driving electrode 18 and an impedance sensing electrode 19 (emphases added).

The impedance sensing electrode 19, in combination of the transducer 88, is used for sensing purpose only, but is not used to generate any acoustic force to maintain or change particle positions.

In fact, Yasuda teaches away from such combination to arrive at the presently claimed invention. The test for "teaching away" is that a "reference will teach away if it suggests that the line of development flowing from the reference's disclosure is unlikely to be productive of the result sought by the applicant." *In re Gurley*, 27 F.3d 551, 553, 31 USPQ.2D 1130, 1131 (Fed. Cir. 1994). In addition, if proposed modification would render the prior art invention being modified unsatisfactory for its intended purpose, then there is no suggestion or motivation to make the proposed modification. *In re Gordon*, 733 F.2d 900, 221 USPQ 1125 (Fed. Cir. 1984) (Claimed device was a blood filter assembly for use during medical procedures wherein both the inlet and outlet for the blood were located at the bottom end of the filter assembly, and wherein a gas vent was present at the top of the filter assembly. The prior art reference taught a liquid strainer for removing dirt and water from gasoline and other light oils wherein the inlet and outlet were at the top of the device, and wherein a pet-cock (stopcock) was located at the bottom of the device for periodically removing the collected dirt and water. The reference further taught that the separation is assisted by gravity. The Board concluded the claims were *prima facie* obvious, reasoning that it would have been obvious to turn the reference device upside down.

The Court reversed, finding that if the prior art device was turned upside down it would be inoperable for its intended purpose because the gasoline to be filtered would be trapped at the top, the water and heavier oils sought to be separated would flow out of the outlet instead of the purified gasoline, and the screen would become clogged.).

The apparatuses and methods of the present invention, in the presently amended form, require that that at least two electrode elements be non-movably adapted along a portion of the chamber and the at least one piezoelectric transducer be non-movably adapted along a portion of the chamber. Both electrode elements and the piezoelectric transducer are used to generate electrical force and acoustic force having components normal to the traveling direction of the carrier medium. Combining Yasuda with Becker to arrive at the presently claimed apparatuses and methods would render the apparatuses of Yasuda inoperable for their intended purposes. The apparatuses shown in Figure 10 of Yasuda are used to promote cell fusion. The ultrasonic wave oscillators 31 and the acoustic lens 32 are used to trap a cell at the focal point of ultrasonic waves (*See* Yasuda at column 10, lines 26-27). In order to do that, the position of the focal point can be moved by moving a unit, including the ultrasonic wave oscillator 31 and the acoustic lens 32 by a three-dimensional manipulation unit 35. In other words, making the ultrasonic wave oscillators 31 and the acoustic lens 32 non-movably adapted along a portion of the chamber, as required by the present claims, would render the apparatuses shown in Figure 10 of Yasuda inoperable. For the same reason, the pair of two-dimensional arrays of transducers 39, as shown in Figure 12 of Yasuda, cannot be non-movably adapted along a portion of the chamber. The apparatuses shown in Figure 13 of Yasuda are used in gel-electrophoresis. Accordingly, the electrophoretic force must be in the direction of particle movement, but cannot be normal to the direction of the particle movement.

In addition, even assuming, *arguendo*, there were motivation to combine the references, combination of the teachings of these references would not result in all the elements of presently pending claims. Each of the presently pending claims has the limitation "at least two electrode elements non-movably adapted along a portion of said chamber" and "at least one piezoelectric transducer non-movably adapted along a portion of said chamber." As discussed above, for the apparatuses shown in Figures 10 and 12 of Yasuda, the elements for generating acoustic force is movably bound. For the apparatuses shown in Figure 11 of Yasuda, either acoustic force or electrophoretic force, but not both, is used. For the apparatuses shown in Figure 13 of Yasuda, the electrophoretic force is in the direction of particle movement, but is not normal to the direction of the particle movement. Becker does not cure the defects of Yasuda because, in Becker' apparatuses, no acoustic force is used to maintain or change particle position at all.

It is respectfully submitted that the rejections of claims 25-41, 44-48, 65-78 under 35 U.S.C. § 103 have been overcome by the above remarks and/or amendments and must be withdrawn. Early allowance of the pending claims 25-41, 44-48 and 65-78 are earnestly requested.

CONCLUSION

In the unlikely event that the transmittal letter is separated from this document and the Patent Office determines that an extension and/or other relief is required, applicant petitions for any required relief including extensions of time and authorizes the Assistant Commissioner to charge the cost of such petitions and/or other fees due in connection with the filing of this document to **Deposit Account No. 03-1952** referencing docket no. 471842000200. However, the Assistant Commissioner is not authorized to charge the cost of the issue fee to the Deposit Account.

Respectfully submitted,

Dated: July 8, 2003 By: _____

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